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ABSTRACT

It was hypothesized that by age 8 children would manifest an adult meaning system, and that 5-year-old children would not. An adult meaning system allows an adult to transcend component word meanings and integrate, in the presence of a speaker, the underdetermined and the factual proposition into a meaningful whole. Subjects were 60 5- and 8-year-old middle class, racially mixed children. Subjects were asked to repeat sentences heard in conversation and on tape. Sentences included: (1) those with referential nouns, (2) those with "modals," and (3) control sentences containing neither. A three-way analysis of variance was computed on age by condition by sentence type, using the two ages, the two conditions, and the modal and control sentences. Results indicate that recall of the modal sentences is better than the control sentences heard in conversation but not heard on tape. The interaction of sentence by age shows that the older, but not the younger, subjects perceive the difference between the modal and control sentences. This supports the hypothesis. All subjects, however, master sentences containing referential nouns. Both the modal and the referential systems seem to be necessary to understand sentence meaning. (JF)

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The Role of Underdeterminacy and Reference in the Sentence Recall of Young Children [1, 2]

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The research or work reported herein was performed pursuant to a contract with the Office of Education, U.S. Department of Health, Education, and Welfare through the Chicago Early Education Research Center, a component of the National Laboratory on Early Childhood Education, contract OEC-3-7-070706-3118.

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In an early experiment (Feldman, in press) a meaning system which involves an interaction of sentence type with presentation condition was found to affect adult recall. Adults were shown to process sentences with "underdetermined" structures (modal: "would", "could", "even", and "only") in a different manner than sentences with non-underdetermined structures; this difference occurred only in presentation conditions approximately those of an ordinary conversation, as opposed to tape-recorded presentations. Sentences which contain egocentric particulars ("I", "here", etc.), modals, and other linguistic units which work in a similar manner, are those into which it is easiest for a speaker to inject his personal feelings and beliefs about the fact asserted in a sentence. Highly meaningful sentences, in this context, are those which are structurally adapted for conveying information about the state of the speaker with respect to the fact about the world expressed in the sentence. It is this interaction of subjectivity with expressed fact which constitutes the meaning of the sentence. In this sense, the meaning of the underdetermined element is not merely additive, but global, in that it affects the meaning of the sentence as a whole. When an underdetermined sentence is uttered in the absence of a speaker, e.g., on a tape recording, it is now wholely meaningful to the person hearing it because the sentence conveys information about a speaker who is not there. The minimal

approximation to an ordinary conversation, then, is that the sentence be spoken by a speaker who is present. This requirement, at least, is necessary for underdetermined elements to be effective, and thus for the meaning of underdetermined sentences to be manifest to the adult listener. The meaning system of the adult listener is such that it allows him to transcend mere component word meanings and integrate, in the presence of a speaker, the underdetermined elements and the factual proposition into a meaningful whole.

It is important from a developmental perspective to establish the age at which this meaning system emerges in children. Many studies in recent years have shown that relevant changes in cognitive functioning occur during the five- to seven-year-old age span (White, 1965). According to White, the transition during this period is "from animal-like to human-like learning". More complex mediational processes begin to affect the organism's performance. Children begin to consider relationships between things, and begin to acquire the ability to withhold response in order to consider these relationships. They are no longer limited to considering the world in terms of discrete stimuli. The correspondence between general cognitive structure with this dimension added and the adult meaning system is striking, for it

is this relational capability which is required for perceiving the effect of underdetermined elements on sentence meaning. On the basis of the relevance of such general learning processes to meaning systems, it was hypothesized that by age eight children will manifest, to some degree, the adult meaning system discussed above, and that five-year-old children, just beginning the transition, will not.

Reference, the use of a word to refer to a thing in the world (Brown, 1958), suggested at least a partial answer to the question of the character of the cognitively simpler five-year-old's meaning system. Brown points out that children first acquire meaning by matching words to their referents; this is "the original word game". Since five-year-olds are limited to consideration of individual elements, it was hypothesized that reference would constitute an important part of their meaning system. Further, unlike the global nature of underdetermined elements with respect to sentence meaning, referential elements were not expected to interact with other elements in the sentence. Since the referential meaning system is of much simpler nature than the adult system discussed above, it should be developmentally prior to the adult system. Finally, unlike in the adult meaning system, referentially should be unaffected by presentation condition.

Method

Subjects

The subjects were a middle-class, racially mixed group of children attending a summer day camp in Chicago at the Hyde Park Y.M.C.A. Fifteen subjects at each of two ages were run in each of the two presentation conditions for a total of 60 subjects. The younger group of subjects had a range of five years, three months to five years, eleven months, with a mean of five years, eight months. The older group had a range of eight years, one month to nine years, with a mean of eight years, seven months. In this paper the two groups are referred to respectively as "five-year-olds" and eight-year-olds". Half of the subjects were male, and half were female, distributed as equally as possible between groups. Subjects were tested individually.

Conditions

There were two conditions, conversation and tape. For the conversation condition an effort was made to create the impression that the speaker was having a conversation with the hearer. The speaker was present and facing the subject. There was no effective way to convince the subjects that the speaker was spontaneously producing the sentences. Therefore, the device of having the subject

reply was adopted so that the subject would become involved and hence perceive the sentences with somewhat the same set as he would a normal conversation. Thus, the experimenter read a sentence; the child replied, and then repeated the stimulus sentence. After replying ("answering"), subjects were instructed to repeat ("Say what I said"). In the tape condition, a pre-recorded tape was played to the children, who were instructed to repeat exactly what they heard, after each sentence. The data used in this study were tape-recorded repetitions of the stimulus sentences.

Sentences

For presentation in the tape condition the sentences were recorded with fifteen-second intervals between them. There were three groups of ten sentences: those with referential nouns; those with "modals"; and the control group with neither. Sentences were approximately twelve words long. The control sentences consisted of an article, followed by a noun designating a familiar object, followed by a predicate complement selected so that the whole sentence would make sense. In addition, in each sentence as adjective was inserted between one of the nouns, and an extra clause was inserted to make the sentences long enough for a repetition task, but neither the adjective nor the clause was coded.

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In the "modal" sentence group, one of the following words was added: should (have), would (have), could (have), must (have), might (have), even, only, wished, hoped, and believed. Sentences in the referential group were constructed in the same manner as those in the control group; however, in the referential group all of the sentence subjects (N_1) referred to objects which were presented at the same time that the sentence was read. An example of a modal sentence is, "The baseball player swung his bat and should have hit the ball." An example of a referential sentence is, "The shiny truck was turning into the street and it put on its brakes." An example of a control sentence is, "The yellow bird was flying over the trees and singing a little song."

Results

The two major questions posed in this study centered on the modal and referential sentences separately. First, the results for the modal sentences will be considered. A three-way analysis of variance was computed on age by condition by sentence type, using the two ages, the two conditions, and two of the three sentence types: modal and control (Table I). The unit to measure sentence meaning was correct recall of the subject-verb-object (NVN) combination, as this was the common denominator of all the various sentence types. The main effects for age

($F = 12.94$, $p < .01$) and condition ($F = 8.64$, $p < .01$) are both significant. This indicates that the performance of the eight-year-olds is superior to that of the five-year-olds, and that subjects generally did better in the tape condition than in the conversation condition. All three double interactions are significant. This significance of the interaction condition by age ($F = 11.71$, $p < .01$) suggests that the eight, but not the five-year-olds, perform differentially in the tape conversation conditions. Likewise, the interaction of sentence by age ($F = 6.40$, $p < .05$) indicates that the older, but not the younger, subjects perceive the difference between the modal and control sentences. The last of the double interactions, sentence by condition, is particularly important in that it indicates that the tape and conversation conditions have different effects on recall of the two types of sentence - modal and control. In fact, whereas in the tape condition the recall of control sentences is better than that of modal sentences, in the conversation condition the recall of modal sentences is better than that of control sentences. Finally, the triple interaction ($F = 22.55$, $p < .01$) is significant as well, indicating as predicted that for the older subjects, in the conversation but not the tape condition, there was better recall of modal than of control sentences. These results strongly support the expectations concerning the adult meaning system described above.

In order to gain a clearer understanding of the interaction effects suggested in the ANOVA, several subtests were done. Since the adult meaning system is characterized by the necessity of some minimal conversation condition to give full meaning to the underdetermined elements and thus to the whole sentence, and since it was hypothesized that this meaning system would be apparent by the age of eight, a crucial part of the analysis concerned the eight-year-olds' recall of modal and control sentences in the conversation condition. The result is as predicted; eight-year-olds do recall the NVN unit better for modal than for control sentences ($t = 2.40$, $p < .025$) in the conversation condition, but not in the tape condition (Table II). This indicates that by the age of eight the adult meaning system has essentially emerged. On the other hand, the five-year-olds do not do better on the modal than on the control sentences in either condition; that is, five-year-olds do not manifest the adult meaning system.

Similar to the NVN unit as representative of sentence meaning is the verb. According to Gollob (1967) the verb is the single most important sentential element affecting meaning. Analysis of verb recall shows results similar to that of the NVN units, suggesting in a related way the presence of the adult meaning system in eight-year-olds. Recall of the verb in modal vs. control sentences is affected

by condition for the eight-year-olds but not for the five-year-olds (Table III). The eight-year-olds did significantly better on recall of verbs from modal than from control sentences ($t = 3.51$, $p < .005$) in the conversation condition but not the tape condition.

The five-year-olds were not expected to and did not manifest the adult meaning system. At least in this respect their meaning system is not as complex as that of the eight-year-olds. The five-year-olds do, however, manifest the referential meaning system. Evidence for this meaning system is found in the greater recall of a word when its referent is present than when its referent is not present. In this study the dependent variable is the first noun (N_1) for which in referential sentences the referent was presented (and for which in the control sentences the referent was not presented). Condition was not expected to affect recall of N_1. As expected, five-year-olds did do better in recall of N_1 in the referential sentences than in the control sentences, in both tape ($t = 4.71$, $p < .005$) and conversation ($t = 4.33$, $p < .005$) conditions (Table IV). That this difference is attributable to the referential character of N_1 can be seen by looking at differences between N_1 and N_2 (the second noun, for which a referent was never presented) in the referential and control sentence groups (Table V). Significant differences between recall

of N_1 and N_2 were obtained in both age groups for referential sentences, but not for control sentences. This result is explained by the local effect of the referent. The referent affects N_1 alone but does not affect the meaning of the sentence as a whole. In respect to the local nature of this effect, the referential meaning system differs from the adult meaning system. Another difference between the two systems is that the referential system is active without regard to condition, whereas the adult system is dependent on the conversation condition. Finally, the referential system persists beyond the age at which the adult meaning system begins to manifest itself.

Discussion

The eight-year-olds evidence both the referential and the modal meaning systems. It is suggested that the systems are compatible precisely because of the great difference between them. Both systems seem to be necessary for an understanding of sentence meaning. The referential system is necessary because it partly accounts for word meanings which contribute to an understanding of the sentence as a whole; the adult meaning system is necessary for the subtler and richer sentence meaning which goes beyond meaning of the component words. The meaning of sentences with underdetermined elements is activated when a hearer perceives

the sentence as coming from a speaker, as in the conversation condition used here.

While the eight-year-olds do manifest the adult meaning system, they also exhibit a phenomenon not found in the earlier adult study. In general, children at this age do considerably better in the tape than in the conversation condition. One explanation for this seems to be that in the conversation condition there was interference with recall arising from replying, while in the tape condition there was no such interference. That this phenomenon is transient is indicated by the fact that neither the five-year-olds nor the adults showed this general recall decrement in the conversation condition.

In a subsequent study it was found that for eight-year-olds, answering had an effect much more profound than interference with recall. The adult meaning system is observed in eight-year-olds in spite of the interference experienced in the conversation condition. The main features of that condition are the presence of a speaker and the "answer" requirement. A pilot study was conducted to determine how much each of these two features was contributing to the observed condition difference. Besides the original two conditions, tape and conversation (C_1), a third

condition was used in which a speaker was present but the subject was not required to answer (C_2). The subjects were eight years old. There is no difference between modal and control sentences in C_2 (modal recall - 89; control sentence recall - 90). C_2 does not act like a conversation condition, but like the tape condition, in which there is also no difference between sentence types (modal recall - 82; control sentence recall -86), suggesting that answering is needed to establish conversational set in eight-year-olds. Since these two conditions are comparable, their average recall was computed and compared with the recall in C_1. Recall in the control sentence group in 66 in C_1 as compared to 88 in T-C_2; recall in the modal sentence group is 76 in C_1 as compared to 85.5 in T-C_2. In the control sentence group there is a decrement of 22 from T-C_2 to C_1, while in the modal group there is only a decrement of 9.5 from T-C_2 to C_1. The recall decrement in both sentence groups can be attributed to interference from replying, but the decrement in the control sentence group is much greater than in the modal group. A possible explanation for this is that C_1 brings out the meaning of the underdetermined elements. This enhancing effect of C_1 on modal sentences reduces the decrement. Thus, at least for eight-year-olds, answering has a two-fold effect: it creates

a conversational set and it causes interference in recall. Perhaps it is a new perspective on conversation caused by the onset of the adult meaning system which creates the interference. Despite this variation, the major characteristics of the adult meaning system are observable in eight-year-olds.

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Footnotes

1. The research or work reported herein was performed pursuant to a contract with the Office of Education, U. S. Department of Health, Education, and Welfare through the Chicago Early Education Research Center, a compoment of the National Laboratory on Early Childhood Education. Contractors undertaking such work under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the work. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

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TABLE I *
Three-way Analysis of Variance
Age X Sentence Type (Modal and Control) X Condition
(Significant Results)

	DF	SS	MS	F	P<
Sentence	1	.68	.68	1.19	N.S.
Sentence x Age	1	3.68	3.68	6.402	.05
Sentence x Condition	1	12.94	12.94	22.55	.01
Sentence x Age x Condition	1	9.71	9.71	16.92	.01
Error	84	48.23	.57	---	---
General Effect	1	4284.08	---	---	---
Age	1	54.68	54.68	12.94	.01
Condition	1	36.48	36.48	8.64	.01
Condition x Age	1	49.44	49.44	11.71	.01
Error	84	354.83	4.22	---	---

* Cochran's method was used.

TABLE II
Recall of NVN In Modal and Control Sentence Groups for Five- and Eight-Year-Old Subjects at Each Condition

	Condition			
	Tape		Conversation	
Sentence Group	Five Year Olds	Eight Year Olds	Five Year Olds	Eight Year Olds
Modal	4.80	7.60	5.60	6.20
Control	5.53	8.00	5.27	4.80
	$t = 2.22$	$t = 1.03$	$t = 0.44$	$t = 2.40$
	$p < .025$	N.S.	N.S.	$p < .025$

TABLE III
Recall of Verb in Modal and Control Sentence Groups for Subjects in Each Condition at the Two Ages

	Condition			
	Tape		Conversation	
Sentence Group	Five Year Olds	Eight Year Olds	Five Year Olds	Eight Year Olds
Modal	6.73	8.87	7.20	7.93
Control	6.93	8.60	6.67	6.33
	t = .543	t = .59	t = .632	t = 3.51
	N.S.	N.S.	N.S.	$p < .005$

TABLE IV
Recall of N_1 in Referential and Control Sentence Groups for Subjects in Each of the Two Conditions at Each of Two Ages

	Condition			
	Tape		Conversation	
Sentence Groups	Five Year Olds	Eight Year Olds	Five Year Olds	Eight Year Olds
Referential	8.87	9.80	9.40	9.60
Control	7.07	9.20	8.07	7.73
	$t = 4.71$	$t = 2.197$	$t = 4.33$	$t = 4.81$
	$p < .005$	$p < .025$	$p < .005$	$p < .005$

TABLE V
Recall of N_1 and N_2 in the Referential and Control Sentence Groups for Subjects at the Two Ages, Tape and Conversation

	Sentence Groups			
	Referential		Control	
	Five Year Olds	Eight Year Olds	Five Year Olds	Eight Year Olds
N_1	9.13	9.70	7.57	8.47
N_2	7.83	8.57	7.80	8.23
	t = 5.7522	t = 4.724	t = 0	t = .6401
	p < .005	p < .005	N.S.	N.S.